ABSTRACT

The present work gives an overall view of sol-gel approaches, which have shown promising results in producing some useful materials for photonic applications. The thesis is mainly concerned with the synthesis/characterization of rare earth doped glasses and nanostructured semiconductors codoped with rare earth ions incorporated (dispersed homogeneously) within the glass matrix. These glasses were studied by a variety of techniques, like UV-visible spectroscopy, TEM, X-ray diffraction studies, FT-IR analysis, Raman spectroscopy, TGA/DTA, Z-scan technique etc to name a few.

The spectroscopic and optical features of rare earth ions in glasses, mainly europium ions codoped with semiconductor nanoparticles of ZnSe are described for their qualitative and quantitative aspects. A brief account of phonon side band analysis of semiconductor/rare earth doped glassy materials are also incorporated. The Z-scan technique is used for the study of non linear absorption in ZnSe/Eu$^{3+}$ samples. Characterization of II-VI semiconductor cadmium telluride codoped with Sm$^{3+}$ ions, air annealed at 50, 200, 500 and 800 °C are done. The role of oxygen during heat treatment on the structural and optical properties of CdTe crystallites doped in silica matrix has been studied using XRD and TEM techniques.

The Judd-Ofelt theoretical analysis of rare earth ions in composite media are touched up on. The dielectric properties, micro hardness of doped sol-gel glasses, and their significance are outlined. Thermogravimetric analysis and differential thermal analysis techniques are used to analyse structural changes during annealing at different temperatures.

Key words: sol-gel process, nanostructured semiconductors, rare earths, UV-visible spectroscopy, X-ray diffraction studies, FT-IR analysis, Raman spectroscopy, Z-scan technique